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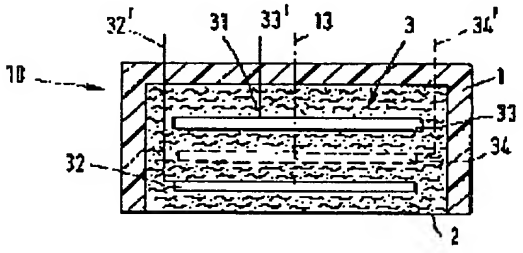
(54) ELECTROCHEMICAL GAS SENSOR ASSEMBLY

(54) DETECTEUR DE GAZ ELECTROMECANIQUE

Representative Drawing:



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ABSTRACT:

To ensure good replaceability and better adaptation and usability of gas sensors of different suppliers and to reduce the number of different gas supply assemblies, the electrochemical gas sensor assembly comprises a gas sensor
(10) having a first principal axis (13) and containing, in a casing (1) with a gas inlet/outlet (2), a sensing element
(3) which comprises an electrolyte (31), at least one working electrode (32), and a reference electrode/counterelectrode
(33) with respective leads (32' 33'). The gas sensor assembly further comprises a connecting element (4) having a second principal axis (43) aligned with the principal axis (13). By means of the connecting element (4) the gas sensor is permanently fastened to a gas supply assembly (5) for a gas mixture containing a gas to be measured, also in a direction of the aligned principal axes, but easily separable therefrom without the need to use an auxiliary device, e.g. a screwdriver or the like.

CLAIMS: Show all claims

*** Note: Data on abstracts and claims is shown in the official language in which it was submitted.

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Electrochemical Gas Sensor Assembly

FIELD OF THE INVENTION

The present invention relates to an electrochemical gas sensor assembly comprising an electrochemical gas sensor.

BACKGROUND OF THE INVENTION

Commercially available gas sensors have not been standardized so far as regards their external shape and external dimensions. On the other hand, the user must mount the gas sensors on a self-produced gas supply assembly, which is therefore not standardized, either. No attention has so far been paid to good replaceability; in most cases, the gas sensors were permanently fastened to the gas supply assembly by means of several screws extending through the sensors. To temporarily fastening the gas sensor during calibration, a Velcro fastening has been described.

SUMMARY OF THE INVENTION

If the user uses gas sensors from several suppliers, he must provide differently shaped and dimensioned, generally self-produced gas supply assemblies. Furthermore, the gas sensors must be fastened to the respective gas supply assembly in such a way that the gas sensor will not separate itself from the gas supply assembly during opreation.

Accordingly, to both ensure good replaceability and better adaptation and usability of gas sensors of different suppliers and reduce the number of different gas supply assemblies, i.e., to achieve greater uniformity, there is a need to provide an improved gas sensor assembly.

On the other hand, worn-out or defective gas sensors should be easely replaceable. This is a requirement which cannot be met with the prior-art gas sensor assemblies referred to above, since they are all screwed to together except the gas sensor assembly with the Velcro fastening; the latter, whose purpose is to permit calibration for a limited time, is not suitable for continuuos operation over long periods of time.

To meet these needs, the invention provides an electrochemical gas sensor assembly comprising:

a gas sensor having a first principal axis; and

a connecting element having a second principal axis aligned with the first principal axis,

said gas sensor containing, in a casing with a gas inlet/outlet, a sensing element

which comprises an electrolyte as well as at least one working electrode and one reference electrode/counterelectrode with respective leads, and

by means of which connecting element the gas sensor is permanently separably fastened to a gas supply assembly for a gas mixture containing a gas to be measured, also in a direction of the aligned principal axes, but easely separable therefrom without the need to use an auxiliary device.

According to a first development of the invention, the electrochemical gas sensor assembly comprises a filter which essentially lets through the gas to be measured with the gas sensor assembly while virtually holding back other gases to which the sensing element is sensitive in addition to the gas to be measured, and which is disposed between the gas inlet/outlet, which does not represent a diffusion barrier for the gas to be measured, and the connecting element.

Preferably, the filter is provided with a diffusion barrier for the gas mixture on a side facing the gas supply assembly or the sensing element.

According to a second development of the invention, the electrochemical gas sensor assembly comprises a filter which essentially lets through the gas to be measured with the gas sensor assembly while virtually holding back other gases to which the sensing element is sensitive in addition to the gas to be measured, and which is disposed between the gas inlet/outlet, which is designed as a diffusion barrier for the gas to be measured, and the connecting element.

According to a third development of the invention, the electrochemical gas sensor assembly comprises a filter which essentially lets through the gas to be measured with the gas sensor assembly while virtually holding back other gases to which the sensing element is sensitive in addition to the gas to be measured, and which is disposed within the gas sensor between the gas inlet/outlet, which is designed as a diffusion barrier for the gas mixture, and the sensing element, or which is disposed within the gas sensor between the gas inlet/outlet, which does not represent a diffusion barrier for the gas mixture, and the sensing element,

in which case the filter
either has no diffusion barrier
or is provided with a diffusion barrier for the gas mixture on a side facing the gas supply assembly or the sensing element.

According to a first advantageous feature of the invention and of any one of the three aforementioned developments, the gas sensor and the connecting element are securely, but easily separably joined by means of a threaded connection, particularly by means of an external thread on the gas sensor and a corresponding internal thread in the connecting element.

According to a second advantageous aspect of the invention and of any one of the three aforementioned developments, the gas sensor is provided with a first part of a bayonet joint and the connecting element is provided with an associated second part of the bayonet joint.

According to a third advantageous feature of the invention and of any one of the three aforementioned developments, the connecting element is provided with a spring clip which grips the gas sensor or the gas sensor and the filter in the locked condition.

According to a fourth advantageous feature of the invention or of any one of the three aforementioned developments, the connecting element is provided with hinged stirrup springs which clasp the gas sensor or the gas sensor and the filter in the connected condition.

According to a fifth advantageous feature of the invention or of any one of the three aforementioned developments, the gas sensor is provided with lateral projections, particularly with resilient projections, which engage in corres-

ponding lateral depressions of the connecting element, or vice versa.

According to an advantageous aspect of the fifth feature, the projections form an annular bead and the depressions form an annular groove which fits the annular bead.

According to a further aspect of the invention, of the three aforementioned developments, or of the five aforementioned features, the gas sensor and the connecting element may be cylindrical.

According to still another aspect of the invention, of the three aforementioned developments, or of the five aforementioned advantageous features, the casing may consist of a casing pot and a casing cover.

According to a still further aspect of the aforementioned developments in conjunction with the aforementioned fifth advantageous feature of the invention, the filter may be mounted on or in an inner side of the casing cover.

According to a fourth development of the invention with cylindrical gas sensors and with respective cylindrical connecting elements, the individual gas sensors may have outside diameters differing from unit to unit and ranging between a maximum value and a minimum value, and the respective connecting element always has an inside diameter equal to the maximum value, and a respective intermediate ring is provided whose radial width is equal to the difference between the maximum value of the inside diameter of the connecting element and the respective outside diameter of the gas sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be explained in more detail with reference to the accompanying drawings, which are not to scale and show, inter alia, embodiments of the invention, and in which, as far as possible, reference characters which have already been used in one of the figures do not reappear in subsequent figures to simplify the illustration. In the drawings:

Fig. 1 is a schematic cross section showing the basic construction of a gas sensor;

Fig. 2 is a schematic cross section showing the basic construction of a gas sensor with a diffusion barrier in a gas inlet/outlet;

Fig. 3 is a schematic cross section of the first embodiment, comprising a gas sensor as shown in Fig. 1;

Fig. 4 is a schematic cross section of a first variant of a second embodiment, comprising a gas sensor which requires a diffusion barrier;

Fig. 5 is a schematic cross section of a second variant of the second embodiment, comprising the gas sensor which requires a diffusion barrier;

Fig. 6 is a schematic cross section of a third variant of the second embodiment, comprising the gas sensor which requires a diffusion barrier;

Fig. 7 is a schematic cross section of a fourth variant of the second embodiment, comprising the gas sensor which requires a diffusion barrier;

Fig. 8 is a schematic cross section of a particularly advantageous embodiment suitable for use with the gas sensor shown in Fig. 1, comprising a casing pot and a casing cover;

Fig. 9 is a schematic cross section of a particularly advantageous embodiment suitable for use with the gas sensor shown in Fig. 2, comprising a casing pot and a casing cover;

Fig. 10 is a schematic cross section of a particularly advantageous embodiment suitable for use with the gas sensor shown in Fig. 3, comprising a casing pot and a casing cover;

Fig. 11 is a schematic cross section of a particularly advantageous embodiment suitable for use with the gas sensor shown in Fig. 4, comprising a casing pot and a casing cover;

Fig. 12 is a schematic cross section of a particularly advantageous embodiment suitable for use with the gas sensor shown in Fig. 5, comprising a casing pot and a casing cover;

Fig. 13 is a schematic cross section of a particularly advantageous embodiment suitable for use with the gas sensor shown in Fig. 6, comprising a casing pot and a casing cover;

Fig. 14 is a schematic cross section of a particularly advantageous embodiment suitable for use with the gas sensor shown in Fig. 7, comprising a casing pot and a casing cover;

Fig. 15 is a schematic cross section of a first embodiment of an easily separable connection between connect-ing element and gas sensor, namely a threaded connection;

Fig. 16 is a schematic cross section of a second embodiment of an easily separable connection between connecting element and gas sensor, namely a bayonet joint;

Fig. 17 is a schematic cross section of a third embodiment of an easily separable connection between connect-ing element and gas sensor, namely a connection by means of a spring clip;

Fig. 18 is a schematic cross section of a fourth embodiment of an easily separable connection between connecting element and gas sensor, namely a connection by means of stirrup springs;

Fig. 19 is a schematic cross section of a fifth embodiment of an easily separable connection between connect-ing element and gas sensor, namely a detent mech-anism; and

Fig. 20 is a schematic cross section of a further embodiment for differing diameters of the gas sensor and the connecting element.

DETAILED DESCRIPTION OF THE DRAWINGS

Fig. 1 shows the basic construction of a preferably cylindrical gas sensor 10 in a schematic cross-sectional view. The gas sensor 10 has afirst principal axis 13. A casing 1, made, for example, of a suitable plastic and having a gas

inlet/outlet 2, contains a sensing element 3 which comprises an electrolyte 31 as well as a working electrode 32 and a reference electrode/counterelectrode 33 with respective leads 32′, 33′.

In Fig. 1, a possible third electrode 34 with a lead 34′ is indicated by broken lines. This third electrode 34, if present in a gas sensor, has the separate function of a reference electrode, in which case the reference electrode/counterelectrode 33 acts only a pure counterelectrode. Further electrodes may be provided as required.

The gas inlet/outlet 2 may be either open, i.e., may, in particular, not represent a diffusion barrier for the gas to be measured by the gas sensor 10, as shown in Fig. 1, or be designed as a diffusion barrier 21 for the gas to be measured, as shown in Fig. 2, depending on the gas to be measured. The diffusion barrier 21 may contain capillaries, for example.

Electrochemical gas sensors for measuring the concentration of components of a gas mixture, such as carbon monoxide, nitrogen monoxide, sulfur dioxide, hydrogen sulfide, oxygen, ammonia, or hydrazine, generally have a diffusion barrier, particularly if higher gas concentrations are to be measured and if a linear dependence of the electric gas sensor current on the gas concentration and a low temperature dependence of this current are desired.

If the concentration of the gas to be measured in the gas mixture is very low, as is the case with ozone, chlorine, fluorine, hydrogen chloride, or hydrogen cyanide gas (cyanogen), a diffusion barrier is generally not necessary.

Fig. 3 is a schematic cross section of a first embodiment of the invention with a gas sensor as shown in Fig. 1. By means of a connecting element 4, which has a second principal axis 43, the gas sensor 10 is permanently fastened to a gas supply assembly 5 for a gas mixture containing the gas to be measured, also in a direction of the two aligned principal axes 13, 43, but easily separable therefrom without the need to use an auxiliary device, such as a screwdriver or the like. The permanent connection can thus be separated with bare hands.

The term "permanent connection" as used herein means a fastening or connection which is mechanically permanent as long as it is not intentionally separated. Such a separation is necessary and intended, for example, when a defective or worn-out gas sensor has to be replaced by a new one.

The connecting element has an opening 41, which virtually covers the gas inlet/outlet 2. The supply assembly 5 has a corresponding opening 51, which virtually covers the opening 41.

Since various preferred types of connections which are mechanically permanent also in the direction of the two aligned principal axes 13. 43, but easily separable, are shown in more detail in Figs. 15 to 19 and will be explained with reference to these figures, in Fig. 3 these connections are only symbolized by the reference character 40. Connecting element 4 and gas supply assembly 5 are fastened together at 50 so as to be hard to separate, e.g., by means of several through bolts with associated locknuts or by means of self-tapping screws.

The gas supply assembly 5 is traversed by the aforementioned gas mixture containing the gas to be measured, as is indicated by the arrows. Since Fig. 3 shows a gas sensor

assembly with a gas sensor 10 as illustrated in Fig. 1, i.e., with a gas sensor without a diffusion barrier at or in the gas inlet/outlet 2, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 directly through the openings 51, 41 and the gas inlet/outlet 2 to the sensing element 3.

Fig. 4 shows a schematic cross section of a first variant of a second embodiment, comprising a gas sensor which requires a diffusion barrier. A filter 6 is provided which essentially lets through the gas to be measured while virtually holding back other gases to which the sensing element is sensitive in addition to the gas to be measured.

The filter 6 is provided between the gas inlet/outlet 2, which does not represent a diffusion barrier for the gas to be measured, and the connecting element 4 and is provided with the diffusion barrier 21 on a side remote from the gas supply assembly 5. Thus, because of the aforementioned secure, but easily separable connection, the filter 6 and the gas sensor 10 can be replaced either alone or together if required.

In the variant of the second embodiment shown in Fig. 4, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 to the filter 6 and, after passing through the latter, through the diffusion barrier 21 and the gas inlet/outlet 2 to the sensing element 3.

Fig. 5 shows a schematic cross section of a second variant of the second embodiment, comprising a gas sensor which requires a diffusion barrier. Compared with the first variant of Fig. 4, the order of filter 6 and the diffusion bar-

rier 21 has been reversed. Thus, the diffusion barrier 21 is located on the side of the gas supply assembly, while the filter 6 is located on the side of the sensing element 3.

In the variant of the second embodiment shown in Fig. 5, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 to the diffusion barrier 21 and, after passing through the latter, through the filter 6 and the gas inlet/outlet 2 to the sensing element 3.

Fig. 6 shows a schematic cross section of a third variant of the second embodiment, again with a gas sensor which requires a diffusion barrier. Like in Figs. 4 and 5, a filter 6 with the above-mentiond properties is provided.

In Fig. 6, however, the filter 6 is located within the gas sensor between the gas inlet/outlet 2, which is not designed as a diffusion barrier for the gas mixture, and the sensing element 3. The filter 6 is located on the side of the gas inlet/outlet 2, while the diffusion barrier 21 is located on the side of the filter facing the sensing element. The diffusion barrier 21 may either be a separate component or be formed on the inner surface of the filter 6, or the filter 6 may be designed as a diffusion barrier.

In the variant shown in Fig. 6, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 and the gas inlet/outlet 2 to the filter 6 and, after passing through the latter, through the diffusion barrier 21 to the sensing element 3.

Fig. 7 shows a schematic cross section of a fourth variant of the second embodiment, again with a gas sensor which requires a diffusion barrier. Like in Figs. 4 to 6, a filter 6 with the above-mentioned properties is provided.

Like in Fig. 6, the filter 6 is located within the gas sensor between the gas inlet/outlet 2, which may be designed as a diffusion barrier 21 for the gas mixture, and the sensing element 3. If the gas inlet/outlet 2 is not designed as a diffusion barrier, the side of the filter 6 facing the gas supply assembly may be provided with the diffusion barrier 21 or be designed as a diffusion barrier.

In the variant of Fig. 7, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 and the gas inlet/outlet 2 to the diffusion barrier 21 and, after passing through the latter, through the filter 6 to the sensing element 3.

In the assemblies of Figs. 6 and 7, the filter 6 and the sensing element 3 are no longer replaceable separately; they can only be replaced together.

Figs. 8 to 14 show schematic cross sections of particularly advantageous embodiments which are suitable for use with any of the gas sensors illustrated in Figs. 1 to 7. The casing 1, so far assumed to be of one-piece construction, now consists of a casing pot 11 and a casing cover 12.

Fig. 8 shows this for a gas sensor 10 as illustrated in Fig. 1, e.g., a gas sensor where the gas inlet/outlet 2 in the cover 12 is open and, hence, does not represent a diffusion barrier for the gas to be measured.

Fig. 9 shows this for a gas sensor 10 as illustrated in Fig. 2, i.e., a gas sensor where the gas inlet/outlet 2 in the cover 12 is designed as a diffusion barrier 21 for the gas to be measured.

Fig. 10 shows that an assembly as illustrated in Fig. 3 can also be implemented with a casing divided into a casing pot 11 and a casing cover 12. Via the connecting element 4, casing cover 12 and casing pot 11 are permanently, but easily separably connected with the gas supply assembly 5 in the above-mentioned manner.

Since Fig. 10 shows a gas sensor assembly with a gas sensor 10 as illustrated in Fig. 1, i.e., with a gas sensor without a diffusion barrier at or in the gas inlet/outlet 2, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 and the gas inlet/outlet 2, which is now located in the casing cover 12, to the sensing element 3.

Fig. 11 shows that an assembly as illustrated in Fig. 4 can also be implemented with a casing divided into a casing pot 11 and a casing cover 12. Via the connecting element 4, casing cover 12 and casing pot 11 are permanently, but easily separably connected with the gas supply assembly 5 also in the direction of the two aligned principal axes 13, 43.

Fig. 11 shows a schematic cross section of a particularly advantageous embodiment, comprising a gas sensor which requires a diffusion barrier. The filter 6 again has the above-mentioned properties and, viewed from the gas supply assembly 5, is located in front of the opening in the casing cover 12. The side of the filter 6 facing toward the

sensing element 3 is provided with the diffusion barrier 21 or designed as a diffusion barrier.

In the embodiment of Fig. 11, too, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 to the filter 6 and, after passing through the latter, through the diffusion barrier 21 and the gas inlet/outlet 2 in the casing cover 12 to the sensing element 3.

Fig. 12 shows that an arrangement as illustrated in Fig. 5 can also be implemented with a casing divided into a casing pot 11 and a casing cover 12. Via the connecting element 4, casing cover 12 and casing pot 11 are securely, but easily separably connected with the gas supply assembly 5.

Fig. 12 shows a schematic cross section of a particularly advantageous embodiment, comprising a gas sensor which requires a diffusion barrier. The filter 6 again has the above-mentioned properties and, viewed from the gas supply assembly 5, is located in front of the opening in the casing cover 12. The side of the filter 6 facing toward the gas supply assembly 5 is provided with the diffusion barrier 21 or designed as a diffusion barrier. It is also possible, however, to provide a diffusion barrier which is separate from the filter 6.

In the embodiment of Fig. 12, too, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 to the diffusion barrier 21 and, after passing through the latter, through the filter 6 and the gas inlet/outlet 2 in the casing cover 12 to the sensing element 3.

Thus, in the embodiments of Figs. 11 and 12, the secure, but easily separable connection makes it possible to replace either the filter 6 or the gas sensor 10 alone or both together.

Fig. 13 shows that an assembly as shown in Fig. 6 can also be implemented with a casing divided into a casing pot 11 and a casing cover 12. Via the connecting element 4, casing cover 12 and casing pot 11 are permanently, but easily separably connected with the gas supply assembly 5 also in the direction of the two aligned principal axes 13, 43.

Fig. 13 shows a schematic cross section of a further particularly advantageous embodiment, again with a gas sensor which requires a diffusion barrier. The filter 6 again has the above-mentioned properties but is now provided on, and held in place by, the inside of the casing cover 12. This is advantageously effected by the inner extension 121 of the casing cover 12, as can be seen in Fig. 13.

The filter 6 is provided with the diffusion barrier 21 for the gas mixture, or designed as such a diffusion barrier, on a side facing the sensing element 3, while the opening in the casing cover itself does not represent a diffusion barrier.

In the embodiment of Fig. 13, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 and the gas inlet/outlet 2 to the filter 6 and, after passing through the latter, through the diffusion barrier 21 to the sensing element 3.

Fig. 14 shows that an assembly as illustrated in Fig. 7 can also be implemented with a casing divided into a casing pot 11 and a casing cover 12. By means of the connecting element 4, casing cover 12 and casing pot 11 are permanently, but easily separably connected with the gas supply assembly 5 also in the direction of the two aligned principal axes 13, 43.

The filter 6 is provided with the diffusion barrier 21 for the gas mixture, or designed as such a diffusion barrier, on a side facing the gas supply assembly 5, and the opening in the casing cover itself does not represent a diffusion barrier.

In the embodiment of Fig. 14, the gas to be measured, which is contained in the gas mixture, passes from the gas supply assembly 5 through the openings 51, 41 and the gas inlet/outlet 2 to the diffusion barrier 21 and, after passing through the latter, through the filter 6 to the sensing element 3.

In the embodiments of Figs. 13 and 14, the filter 6 and the diffusion barrier 21 can be removed together with the casing cover 12, and the filter 6 and/or the diffusion barrier 21 can then be replaced as required.

For a tight, but separable fit of the casing cover 12 in the casing pot 11, each of the gas sensor assemblies of Figs. 8 to 12 may inlcude an O ring at 60 (not shown).

Following this description of the basic construction of the gas sensor assembly of the invention with the aid of Figs. 1 to 14, another important aspect, namely the aforementioned permanent, but easily separable connection between the gas sensor 10 and the gas supply assembly 5 by means of the

connecting element 4 will be explained and described. This will be done with the aid of Figs. 15 to 19, which show only the parts of the gas sensor assembly 10 relating to the specific type of connection. The casing cover, which may be provided, is not shown for the sake of simplicity.

In the embodiment shown in Fig. 15 in a schematic cross-sectional view, the permanent, but easily separable connection between casing 1 or casing pot 11 and connecting element 4 is a threaded connection 7. The threaded connection 7 may be formed, for example, by an external thread on the outer side of casing 1 or casing pot 11 and a corresponding internal thread in the connecting element 4. The threaded connection may also be provided in other suitable areas of casing 1 or casing pot 11 and connecting element 4.

Fig. 16 shows in a schematic cross-sectional view that the permanent, but easily detachable fastening can also be formed by means of a bayonet joint 8, a first part of which is provided on casing 1 or casing pot 11 and a second part of which is provided on connecting element 4.

Fig. 17 shows in a schematic cross section that instead of the threaded connection of Fig. 15 or the bayonet joint of Fig. 16, a spring clip 9 may be provided, which is formed on the connecting element 4 and, in the locked condition, grips the casing 1 or the casing pot 11 alone or the casing 1 or the casing pot 11 together with the filter 6.

Preferably, the spring clip 9 comprises two elongate, resilient locking elements 91, 92 which are diametrically opposed to each other at the periphery of the connecting element 4 and, thus, separated by 180°. Locking elements 91, 92 and connecting element 4 thus form a unit.

If the two locking elements 91, 92 should not suffice to form a permanent connection between gas sensor 10 and connecting element 4, e.g., if the gas sensor assembly is exposed by vibrations in operation, further locking elements, particularly a third one, may be provided. These three locking elements must then be arranged at the periphery of the gas sensor 10 with an angular spacing of 120°.

Fig. 18 shows in a schematic cross-sectional view that instead of the threaded connection of Fig. 15, the bayonet joint of Fig. 16, or the spring clip of Fig. 17, two hinged stirrup springs 95, 96 may be provided which clasp the gas sensor or the gas sensor and the filter in the connected condition and whose respective pivot points are provided at the connecting element 4.

If two stirrup springs are provided, they will be located diametrically opposite to each other at the periphery of the connecting element 4, thus being separated by 180°. If three stirrup springs are provided, which may be necessary at locations subject to vibrations, the angular separation will be 120°.

Fig. 19 shows in a schematic cross-sectional view that instead of providing the threaded connection of Fig. 15, the bayonet joint of Fig. 16, the spring clip of Fig. 17, or the hinged stirrup springs of Fig. 18, lateral projections 98 may be formed on the gas sensor 10 which engage in corresponding lateral depressions 99 in the connecting element 4, or vice versa.

Particularly advantageously, this form of permanent, but easily separable joint is designed in the manner of a ball joint. In that case, each of the projections 98 incorporates a spring-operated ball which engages in the corres-

ponding depression 99 and which yields when force is applied for release.

In another, particularly advantageous embodiment of the arrangement of Fig. 19, the projections form an annular bead and the depressions form an annular groove which fits the annular bead. This permanent connection can be easily separated by hand by slightly tilting the gas sensor 10 with respect to the connecting element 4, so that the two principal axes are no longer aligned. Thus, the annular bead is released from the annular groove, so that the gas sensor can be separated from the connecting element by pulling.

Fig. 20 shows how the gas sensor assembly can be enlarged into a system wherein cylindrical gas sensors 10 with outside diameters differing from unit to unit, whose values lie between a maximum and a minimum, can be combined with respective cylindrical connecting elements of constant inside diameter.

To this end, the respective connecting element 4 has an inside diameter equal to the maximum value, and an intermediate ring 20 is provided whose radial width B is equal to the difference between the maximum value of the inside diameter of the connecting element 4 and the respective outside diameter of the gas sensor 10. Such gas sensors with different outside diameters may originate from different suppliers, for example.

In conclusion it should be pointed out that, as shown only in Fig. 20 and if required to ensure mechanical rigidity of the connecting element, the base of the latter should have suitably distributed gas passages rather than a single central opening as is shown in Figs. 3 to 19.

CLAIMS

1. An electrochemical gas sensor assembly comprising:
a gas sensor (10) having a first principal axis (13); and
a connecting element (4) having a second principal axis (43) aligned with the first principal axis,
said gas sensor containing, in a casing (1) with a gas inlet/outlet (2), a sensing element (3)
which comprises an electrolyte (32) as well as at least one working electrode (32) and one reference electrode/counterelectrode (33) with respective leads (32′, 33′) , and
by means of which connecting element the gas sensor is permanently separably fastened to a gas supply assembly (5) for a gas mixture containing a gas to be measured, also in a direction of the aligned principal axes, but easely separable therefrom without the need to use an auxiliary device.

2. An electrochemical gas sensor assembly as claimed in claim 1, comprising a filter (6)
which essentially lets through the gas to be measured with the gas sensor assembly while virtually holding back other gases to which the sensing element (3) is sensitive in addition to the gas to be measured, and
which is disposed between the gas inlet/outlet (2), which does not represent a diffusion barrier for the gas to be measured, and the connecting element (4).

3. An electrochemical gas sensor assembly as claimed in claim 2 wherein the filter (6) is provided with a diffusion barrier (21) for the gas mixture on a side facing the gas supply assembly (5) or the sensing element (3).

4. An electrochemical gas sensor assembly as claimed in claim 1, comprising a filter (6)
which essentially lets through the gas to be measured with the gas sensor assembly while virtually holding back other gases to which the sensing element (3) is sensitive in addition to the gas to be measured, and
which is disposed between the gas inlet/outlet (2), which is designed as a diffusion barrier (21) for the gas to be measured, and the connecting element (3).

5. An electrochemical gas sensor assembly as claimed in claim 1, comprising a filter (6)
which essentially lets through the gas to be measured with the gas sensor assembly while virtually holding back other gases to which the sensing element (3) is sens-itive in addition to the gas to be measured, and
which is disposed within the gas sensor between the gas inlet/outlet (2), which is designed as a diffusion barrier (21) for the gas mixture, and the sensing element (3), or
which is disposed within the gas sensor (10) between the gas inlet/outlet (2), which does not represent a diffusion barrier for the gas mixture, and the sensing element (3),
in which case the filter (6)
either has no diffusion barrier

or is provided with a diffusion barrier (21) for the gas mixture on a side facing the gas supply assembly (5) or the sensing element (3).

6. An electrochemical gas sensor assembly as claimed in any one of claims 1 to 5 wherein the gas sensor (10) and the connecting element (4) are permanently separably fastened together, in particular by means of an external thread on the gas sensor and a corresponding internal thread in the connecting element, also in a direction of the aligned principal axes (13, 43), but easely separable therefrom without the need to use an auxiliary device.

7. An electrochemical gas sensor assembly as claimed in any one of claims 1 to 5 wherein the gas sensor is provided with a first part of a bayonet joint (8) and wherein the connecting element (4) is provided with an associated second part of the bayonet joint.

8. An electrochemical gas sensor assembly as claimed in any one of claims 1 to 5 wherein the connecting element (4) is provided with a spring clip (9) which grips the gas sensor (10) or the gas sensor and the filter (6) in the locked condition.

9. An electrochemical gas sensor assembly as claimed in any one of claims 1 to 5 wherein the connecting element (4) is provided with hinged stirrup springs (95, 96) which clasp the gas sensor (10) or the gas sensor and the filter (6) in the connected condition.

10. An electrochemical gas sensor assembly as claimed in any one of claims 1 to 5 wherein the gas sensor (10) is provided with lateral, preferably resilient, projections (98) which engage in corresponding lateral

depressions (99) in the connecting element (4), or vice versa.

11. An electrochemical gas sensor assembly as claimed in claim 10 wherein the projections form an annular bead and the depressions form an annular groove which fits the annular bead.

12. An electrochemical gas sensor assembly as claimed in any one of claims 1 to 11, comprising a cylindrical gas sensor and a cylindrical connecting element.

13. An electrochemical gas sensor assembly as claimed in any one of claims 1 to 12 wherein the casing (1) consists of a casing pot (11) and a casing cover (12).

14. An electrochemical gas sensor assembly as claimed in claims 5 and 12, wherein the filter is mounted on or in an inner side of the casing cover.

15. An electrochemical gas sensor assembly as claimed in any one of claims 12 to 14 for gas sensors having different outside diameters from unit to unit whose values range between a maximum value and minimum value, said electrochemical gas sensor assembly comprising:

a connecting element (4) whose inside diameter is equal to the maximum value; and
a respective intermediate ring (20) whose radial width (B) is equal to the difference between the maximum value of the inside diameter of the connecting element and the respective outside diameter of the gas sensor.

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